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Sexuality is a law of nature to which the living world has been subject since its beginnings, just as it is today.
GREGUSS

THE CONSERVATION OF BARYON CHARGE AND THE MANIFESTATION OF PAULI'S PRINCIPLE IN THE LIVING WORLD

I. MARÓTI

Department of Botany, Attila József University, Szeged
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Abstract

We have attempted to turn round the traditional biological approach and should like to emphasize in the organization of the inanimate and living world not the difference but what is fundamentally common. We suppose that Pauli's principle and the conservation of the baryon charge manifests itself at the multiplication of cells in the following forms:

1. The genom has — similarly to the proton and neutron (baryon) — an indivisible +1 biological charge. The cells preserve the unit charge in case of division.

2. The "fermion" and "boson" states appear in the animate world, as well.

a) On the basis of the linear arrangement of genes and the 5→3 direction of the transcription, we may order to the "fermions" of the cell a vector number of 1/2 value, a "spin".

b) The molecular fermions at prokaryotic level are: one of the chains ("+" or "−" genom) of RNA and DNA. The "boson" state is represented by the replicative virus RNA with double helix, the RNA–DNA hybrid and DNA.

c) "Fermions" of the eukaryotic cell are: a member of the homologous chromosome pair, resp. a paternal or maternal genome. To the "boson" state, the homologous chromosome pair, resp. the diploid chromosome set correspond.

3. The peculiarity of the genome and chromosome "fermion" manifests itself in the following:

a) The identical gametes don't unite with one another.

b) The identical gametes can "conceal" their "fermion" peculiarity by being inactivated.

c) In homozygotes, in the identical loci of the homologous chromosomes, one of the genes becomes inactivated.

d) The synthesis of rRNA is primarily regulated by the female genome.

4. Hermaphroditism is the specialty but no new acquisition of the living world but it origins from the internal property, organizational basic form of matter. The bilateral (bixesual) organization and sexual polarization show some degrees of evolution.

"Boson" states:	Character and begin of the sexual polarization:
1. Bivalent parity (C^{12}, N^{14}, O^{16} nucleus)	None
2. Molecular diploid (Bacteria)	Gene-level
3. Chromosome diploid (Eukaryote)	Genome-level
a) Hermaphrodite	At the end of the individual development
b) Monoecia	At the middle of the individual development
c) Dioecia	At fertilization

The editing commission does not agree with some establishments of the paper.

Introduction

It follows from the symmetry of space and time that every law of nature is insensible to any operation of shifting in time and space or turning in space. To any property of symmetry a law of conservation corresponds. In this way, for example, the principle of the conservation of energy follows from the symmetry of nature, shown opposite to the shift of time.

The laws of conservation reflect the fact that in nature an order rules and, from this, we may take the hope that the laws of nature can be recognized.

The law of conservation of the number of fermion (baryon, lepton) is one of the most exact laws of nature. One of its consequences is that our Galactic System did not disintegrate into light particles and radiation and, therefore, the atoms, molecules, and the living world could develop.

With the evolution of the living world, matter became more ordered in several ways. The important question is, which of the laws demonstrated in inanimate nature, are also apparent in living organisms. When we look for the effects of the laws of conservation and of the principle of exclusion in living world, we do not expect to find an obvious manifestation of these physical laws but of their appearance at a higher level, in another form.

In this paper, I wish to discuss the following points:

1. I propose that, in the living world, the various types of cell multiplication are processes by which the number of fermions is preserved.

2. I survey the main types of zoogamy from a somewhat novel standpoint and attempt to connect the laws of meiosis with Pauli's principle.

3. I attempt to show that one of the most important "inventions" is sexuality, the origins of which, far from being a recent phenomenon, are effects of the principle of exclusion and, as such, are determined by the state of subatomic particles.

1. Conservation of the fermion charge in the living world

Over an extremely wide spectrum of diverse forms, matter may be considered to exist in three main states: (a) matter as radiation; (b) inanimate matter having a rest mass; (c) animate matter. The creation and stability of the three matter-forms of essentially different quality are guaranteed by the laws of conservation.

According to the second law of thermodynamics, matter has a higher entropy in the form of radiation. On the basis of the considerable stability of the proton, WIGNER (1976) demonstrated that atomic matter does not disintegrate into radiation because the heavy fermions (baryons) carry a baryon charge. The proton does not disintegrate because it is the lightest carrier of the baryon charge and, on decomposition, it cannot transfer its baryon charge to its successors.

Before the elaboration of the neutrino theory of two components — LEE and YANG (1956, 1957); LANDAU (1957) —, MARX (1953) was the first to recognize that a so-called lepton charge can be assigned to particles of half odd-integral spin (leptons). The law of conservation of the number of fermions (baryons, leptons) is one of the most exact laws of nature. The law postulates that if a fermion number of value $+1$ is assigned to every particle of half odd-integral spin and to antifermions the value of fermion number -1 is assigned, then, for all known physical processes, the algebraical sum of the fermion numbers is strictly conserved.

The conservation of fermion number does not mean, even in the world of nucleons, indistructibility, immortality, but does give rise to the extraordinary stability of the proton and electron.

In the living world, conservation of the baryon number ensures the following: the ability of the individual to multiply independently, the "immortality" of cells; and this, *in ultima analysi,* manifests itself in the stability of species.

(A) We endeavour to show the fundamentally common principle underlying extremely diverse physical and biological phenomena: At the eukaryotic cell level, the complete set of haploid chromosomes may be considered as a unit group and hence assigned a unit "biological charge" of +1. This is named, after WINKLER (1920), a genome. The genome has this "charge" property, analogous to that of particles of half-odd integral spin (baryon). On the other hand, conservation of baryon charge means that during cell multiplication, chromosomes may be combined in very different ways but their "+1 biological charge" remains. Such a "charge" assignment is a strict unit; it cannot be divided into fractions without breaking the law of conservation. For the real diploid individuals even nullisomia is already lethal.

(B) In the diploid cell (of "+2 charge") there are two (paternal and maternal), but not identical, genomes of identical chromosome number and very similar mass and structure. In the somatic cell-cycle the two genomes are structurally independent of each other, but in meiosis, at the time of pairing of homologous chromosomes, the two genomes form a single, integrated system (boson). Therefore, their conservation shows a mutual dependence.

(a) In mitosis, the sum of chromosomes (n) of paternal (A) and maternal (a) origin in the daughter cell, is equal to the chromosome number of the parent cells.

(b) The two genomes (i.e. maternal and paternal) can only be propagated together; the chromosome number preserved during division; doubling only the paternal or maternal chromosomes, is therefore prohibited.

(c) As the smallest haploid chromosome number remains unchanged even if the two genomes multiply, the hermaphrodite plants often have polyploidia.

(C) Cells that lose their merismatic ability will sooner or later perish. The bacterium and unicellular are constrained by the principle of conservation to carry out many thousands of biochemical reactions, transformations with a single "aim": to produce two young cells, each of which is identical with the parent cell. These cells are potentially immortal.

The gametic mother cells of multicellular are continuously dividing some of the games become immortal as a result of fertilization. According to Huzella (1953), every individual of the Metazoa living today is derived from the first, primordial germ cell by means of a deathless, endless cell series.

2. The main types of sexual process

In the zygote, the conservation of the haploid chromosome number is ensured by meiosis. In mitosis, the formation of genomes is characterized by the change: 1 "boson"→2 "bosons", and in meiosis by the change: 2 "bosons"→8 "fermions"→ →1 "boson". Theoretically, 1, 2, 3, or 4 zygotes could be produced from the union of the gametes derived from two diploid parent-cells. Nevertheless, if we survey the zoogamic forms, we observe that invariably only one zygote develops.

(A) Uniparental zygote formation

(a) The autocaryogamy of the diatom Chaetoceras borealis. A diploid cell divides by mitosis into two cell nuclei. This is directly followed by reduction division. From the four haploid cell-nuclei two degenerate (0) and two (isogametes) (0) unite to form a zygote. (Fig. 1).

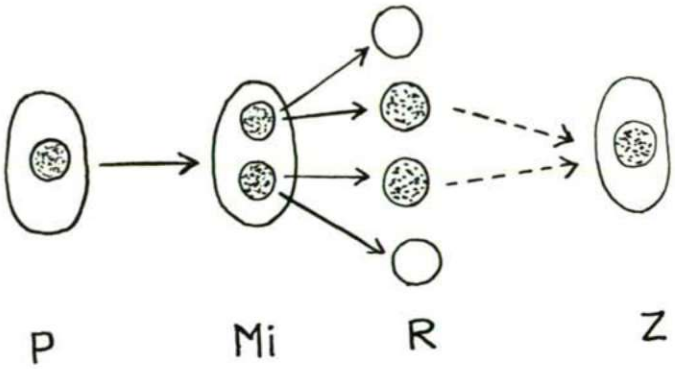

Fig. 1

Scheme of the sexual process of Chaetoceras, according to Chadefaud (1960). P= =parent cell, Mi = mitosis, R = meiosis, Z = zygote. The white circle represents a degenerated cell nucleus.

(b) Autogamy of Actinophrys sol (Heliozoa, an animal monoplast). The diploid cell divides with mitosis into two cells. The sister cells divide with reduction. Two of the four cell-nuclei degenerate (0) and two of them divide thus preserving the number (0). In the second ripening phase, two cell-nuclei degenerate. From the surviving gametes one (of male character) is active in the copulation. Fig. 2.

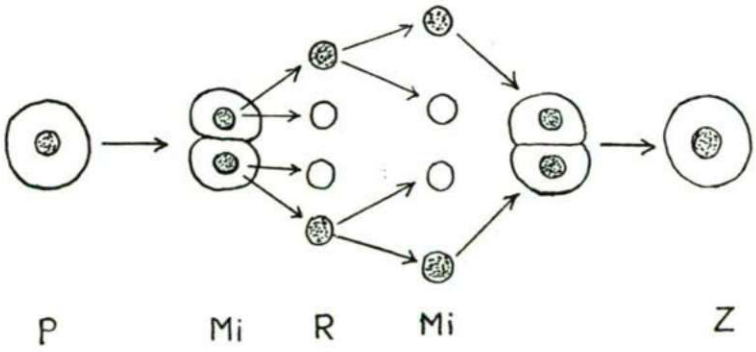

Fig. 2

A scheme of the autogamies of Actinophrys, according to BELAR (1923).

(c) Zoogamy of haploid type of *Hartmannia diploidea* (dispermic amoeba). The cell with dicaryon divides by mitosis into two cells. In the diploid amoeba of

two cells eight cell are produced via reduction division. From these, six degenerate and the remaining two gametes transform with plasmogamy into an amoeba with dicaryon.

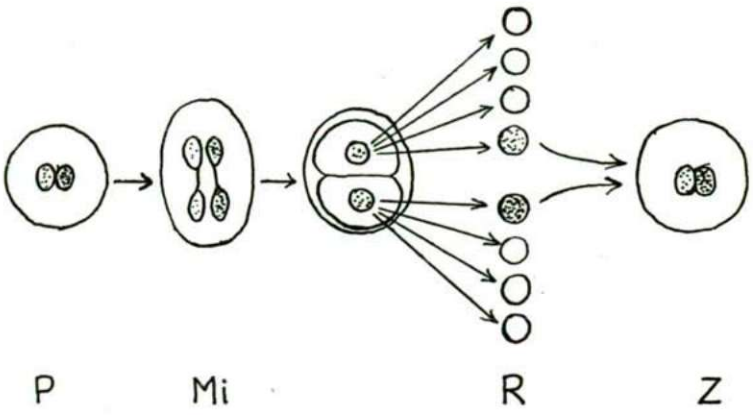

Fig. 3

A scheme of the zoogamy of *Hartmannia diploidea,* according to HARTMANN&NÄGLER (1908, 1956).

The above examples represent the sexual process of monoplasts, the most primitive state of monoecism. The monoparental zygote-formation is, in fact, also bi-parental one because (in the common cell membrane) by bipartition two sister cells (cell nuclei) come about. Fig. 3.

(B) Biparental zygote-formation

(a) Anisogamy of the diatom Chaetoceras borealis. Two different diploid individuals of sexual character align themselves in close proximity and then reproduce first number-preserving, then by redaction division to produce four haploid cell-nuclei each. Two of the nuclei degenerate in each case. In the original cells, sticking together, a smaller gamete of male and a larger one of female character develop in this way. The gametes of male character fuse with the female gametes. Fig. 4.

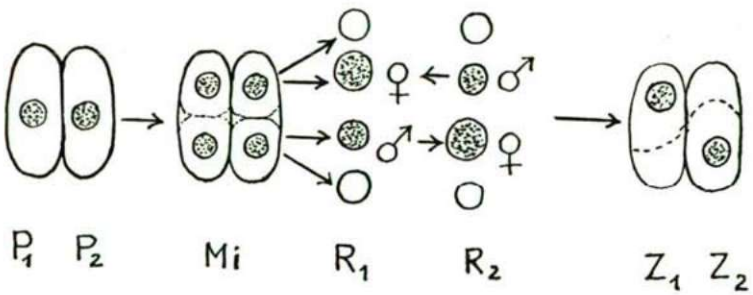

Fig. 4

A scheme of the anisogamy of Chaetoceras borealis, according to Chadefaud (1960).

(b) Conjugation (anisogamy) of *Paramecium*

Conjugation is generally characteristic of the monoplasts (Ciliata) of two kinds of nuclei. Two uniform diploid monoplasts fuse round the edges of their mouths and a cytoplasmic bridge is formed between them. The meganuclei are absorbed and the micronuclei divide, first by mitosis and for the second time by meiosis, creating four descendant nuclei each. From each of these three perish but the fourth nucleus multiplies by bipartition. From this division two nuclei are formed, one of male and another of female character. The male nuclei migrate into the adjacent cell and fuse with the female nucleus.

A scheme of the conjugation of *Paramecia* (Fig. 5).

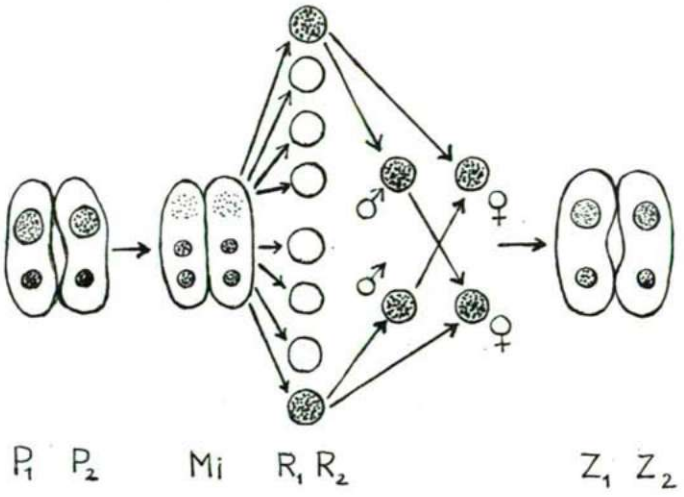

Fig. 5

The number of zygotes produced by iso- and anisogamy corresponds to the number of the parent cells. At oogamy, one zygote is formed from two diploid sexual mother-cells.

(C) Zygote formation by oogamy

The diploid primitive gametes (primitive ovum, primitive spermatozoon) multiply by mitosis so that fewer oogonia and many spermatozoa are formed. Following this, the descendant cells develop into the large oocytes or into the small spermiocytes (i.e., into macro- and microspore mother-cells respectively). Then, in the first maturity phase, they divide by meiosis into two haploid cells. At the end of the second maturity phase (mitosis), four haploid gametes are formed. In the course of the development of oocytes three cell nuclei are absorbed.

The large, immobile ovum encounters and is fertilized by a male gamete. From two diploid cells one zygote is formed. (Fig. 6)

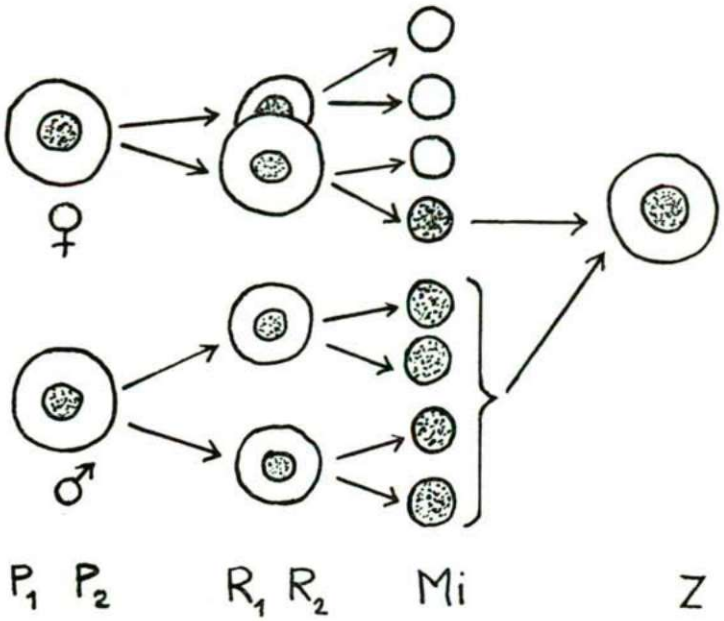

Fig. 6

A scheme of the development of the zygote formed by oogamy (Fig. 6).

The parent cells (P) are in the micro- and macrosphere mother-cell phase. This most developed form of zoogamy is general among the higher living beings (Cormophyta, Acoelomata, Coelomata).

It is, therefore, unambiguously valid in the animal and vegetable kingdoms that from the four haploid cells, formed from the primitive ovum by reduction division, only one becomes fertilized. Question: What is the cause of this?

3. The formations of the cell and Pauli's principle

Despite the general nature of the phenomenon, there is, as yet, no satisfactory attempt in the literature to answer the question, why three cells must perish in the course of the macrosporogenesis. Professor A. ÁBRAHÁM (1977) has suggested a plausible answer, "One of them is surely too many".

Translating this reply into the language of science, we obtain one of the most general laws of nature, Pauli's principle. This principle governs the behaviour of protons and neutrons during the formation of an atomic nucleus. (There is no known stable atomic nucleus consisting of two or more proton. Every atom and, hence, the whole periodic classification of the elements is built on this principle.

Pauli's principle has more than one known formulation:

(A) According to Pauli's original formulation (1925): more than one electron cannot be in the same quantum state. The principle of exclusion, first proposed for

the electron, was later proved to be of general validity for any particle having odd half-integral unit of spin angular momentum (fermion).

(B) According to the second definition: the state-functions of the identical particles of half spin are antisymmetrical, but those of the identical particles having whole spin are symmetrical (1963). The particles having whole spin are termed bosons, those having half spin are fermions. DIRAC (1928), GYÖRGYI (1965).

(C) The third definition of Pauli's principle of exclusion: identical fermions must be separated from one another WEISSKOPF (1973).

It is very useful to state Pauli's principle in detail, and it leads me to the following hypothesis:

(a) The basis of the organization of matter is the formation of the bivalent parity (bosonistate) and the change in the fermion-boson state.
(b) The fermion and boson states also appear in the living world.

At the macromolecular level the fermion state is represented by virus-RNA, pre mRNA and mRNA, as well as by one (+) or other (−) strand of DNA. The boson state is demonstrated by the double-stranded forms of the nucleic acids: the double-stranded virus RNA and the DNA (bacteria, blue-green algae), consisting of a double helix.

The boson state is demonstrated at the eukaryotic cell-level by the homologous pair of chromosomes, and the fermion state is represented by one of the members of the homologous pair of chromosomes or by the haploid chromosome set.

According to the rule of the addition of moments of momentum — MARX (1964), —, from among the four possible spin states (S) of the two different fermions: three may be symmetrical (↑↑): S=1 0,−1 triplet; and one (↓↑) may be singlet: $S=\frac{1}{2}-\frac{1}{2}=0$ state. It is possible to consider the two chains of DNA ("boson") as the singlet state of the two different "fermions". And the homologous chromosomes are in the triplet state at the time of conjugation.

The linear arrangement of genes on the chromosome and the 5→3 direction of the transcription gives a vector character to the chains of RNA and DNA, as well as to the chromosomes. Half a "moment of momentum" may be assigned to a chromosome. According to the vector model of the quantum theory: the resultant of the half-spin of a pair of chromosomes is always an integer — that of an unpaired chromosome is a half. If an integral and a half angular momentum are added up, the resultant will always be a half, GYÖRGYI (1965).

4. The lethal incompatibility of oocytes

The fact that, in the course of oogenesis, three occytes always perish, may be explained if there is always genetic incompatibility between the members of the original set of four oocytes. This incompatibility arises during meiosis. If, after meiosis, zygote formation is not preceded by mitosis (cf. Fig. 4), then only one cell perishes. As regards our central question, why only one ovum ripens, the following answer may be given:

(A) In the course of mitosis, homologous chromosome pairs (bosons) are included in the daughter-cells. For bosons, Pauli's principle is not valid: they can

multiply in the same state, in the same cell. In plants, there is frequently a mitosis in which chromosomes pass only through the S-phase, a process which may be repeated several times, the cell only differentiates after that. FRIDVALSZKY (1972). The endomitotic politenia of Diptera is also well known. Endomitosis is frequent in the vegetable kingdom under natural conditions. GEITLER (1953). On the other hand, the disruption of the nuclear membrane is not required. In the course of mitosis, the chromosomes should reach anaphase MAZIA (1963).

(B) In meiosis, the members of each homologous pair separate from each other (fermions). Before this, at the zygote stage, the homologous chromosomes (fermions) of paternal (A) and maternal (a) origin unite to form a structurally double-particle (boson) system (triplet state). Two conditions pertaining to the pairing of the homologous chromosomes should be mentioned: First, at the zygote stage, the newly synthetized DNA differs in base composition from that synthetized during the S-phase, STERN & HOTTE (1939); on the other hand, the formation of the synaptic complexes MOSES (1932).

Crossing-over increases the identity of homologous, and dissipates the inactive genes. The identical fermions differentiate. The fundamental "sense" of the crossing-over is, therefore, the separation of the homologues of paternal and maternal origin. The selection could not be achieved by the filament of the nuclear spindle.

Such a "reduction" division — as opposed to endomitosis — in which the homologues reman together at the end of the prophase and diploid gametes are formed, is unknown. Polyploid formation of such a character is unknown.

5. Reversible inactivity of male gametes

In animals, it may be considered that the main cause of the oocytic and polycytic "contrast" is the sex chromosome. In mammals, the female sex is characterized by XX and the male sex by XY chromosome pairs. From the oogonium cell, for instance, in human four oocytes (fermions) of 22+X chromosomes develop. The cause of the lethal incompatibility is that closely similar fermions arise. From the primordial spermiocytic cell of the male two 22+X and two 22+Y sperms develop. Between the two spermatozoa with X and the two with Y, incompatibility ought to exist; but it does not!

It is, however, unambiguous that Pauli's principle cannot distinguish between sexes! How is it then that, in the living world, four identical spermatids are formed from the spermatogonium?

There are two possibilities to "deceive" the principle of exclusion:

(a) The developing haploid cells have to conceal their "fermion"-character.

(b) After having developed, they must immediately separate from each other with an oolemma or a cell wall.

And, indeed, CHEN and RUDDLE (1971); ARRIGHI and HSU (1971); JOHN and LEWIS (1975) have demonstrated that in most mammals the chromosomes X and Y are inactive (heterochromatic) at the time of spermatogenesis. In oogenesis, however, the two X chromosomes are active (euchromatic).

In most plants, there is no sexual chromosome; nevertheless, the generative cells — in a similar way to the animal sperm — "conceal" their fermion-state. In 1964, numerous haploid calluses: embryos and plants were produced from Anthera cultures. VASIL and NITSCH (1975), in their comprehensive work, have evaluated

the results so far and shown that haploid was obtained from 56 flowering plant species. But it is startling that they could not show any case where they successfully induced a dividing callus from the generative cell.

According to VASIL and NITSCH, this is surprizing since they obtained several haploid plants from female gametes in natural and in artificial ways.

The generative nuclei are heterochromatic, genetically inactive, in which RNA synthesis is presumably minimal.

One of the most impressive instances of the effectiveness of Pauli's principle is the development of pollen. In the tetrad, the division into two identical fermions is ensured by the thick pollen wall. The single-seeded microspore soon divides in two but the vegetative and generative cells are separated by walls. After the generative cell is divided into two, the sperms become inactive.

6. Is the RNA-synthesis regulated by the female genome?

The incompatibility of identical gametes is supposedly realized in the cytoplasm. The cytoplasm of animal sperms is generally small. The vegetal generative nuclei are generally surrounded by an also hardly discernible, slightly basophilous plasm. By fertilization, almost nothing but the sperm gets into the gigantic cytoplasm of the ovum. Several theories and contrary opinions can be put forward for the molecular evaluation of the transitory inactivity of male gametes at molecular level, with regard to their biological importance. For us, the most probable cause seems to be that ribosome synthesis in the diploid cell can only be regulated by one of the genomes.

It is supposed to be extremely important from the point of view of the genetic stability of the somatic cells and the strictly arranged synthesis of ribosomes that the gene of the precursor of 28 S and 18 S rRNA (45 sRNA) should not be active outside the ovum. More than one datum proves — GALL&PARDUE (1969); GREEN & GERARD (1974); MAHDAVI & GRIPPA (1972) — that the synthesis of the ribosome proteins takes place in the nucleolus, strictly in order and the nucleolus is left by already ready ribonucleo-proteids.

The pre-rRNA genes, connected with the chromosomes organizing the nucleolus, are in the so-called "nucleolus-organizator" region. RITOSSA & SPIEGELMAN (1965). In the male sex gametes this chromosome region is probably inactive. We failed, therefore, to discern a nucleolus in sperms.

What would happen if after fertilization the rRNA genes were activated in the male genome, as well?

RNA-depending DNA-polymerases were found even in embryonal cells that were certainly not infected by any virus. TEMIN&BALTIMORE (1971), GREEN&GERARD (1974). According to TEMIN, in the S-phase of the cell-cycle, the DNA→DNA redoubling ensures the constancy of the genome of cells, while the reverse transcription DNA→RNA→DNA ensures the genetic variability, differenciation of cells.

It was proved in the course of the oogenesis of XENOPUS LAEVIS — BROWN& TOCCHINI—VALENTINI (1972); GALLO (1972) — that at the beginning of the meiosis, the number of genes encoding rRNA in the oocytes quickly increased 1000 to one. The experiment was so evaluated that a gene replication, amplification took place independently of the redoubling of DNA. The amplification of rRNA genes began by the transcription DNA→RNA, then the rRNA molecule served as templat for

the reverse transcription and a RNA—DNA hybrid was formed, and that was transformed by the DNA polymerase into double-chained extra-rDNA.

In the ripe ovum the rDNA-gene amplification stopped, the extra rDNA copies, however, could be integrated into the genome of the male gamete. If the RNA reverse transcription also took place during the meiosis of male gametes or if the synthesis of ribosomes were directed parallel with the female genome by the DNA→RNA protein information in transference, then the genetic stability of the cell would be in danger.

On the other hand, it is also known that the information of viruses is completely transcribed by the ribosomes of the eukaryte cell. Why wouldn't then the genetic information carried by male gametes be just as well transcribed by the ovum?

7. Functional hemizygozity in homozygotes?

The principle of exclusion is favourable to the heterozygous state. It follows from this that:

(A) The amphibious (dioecia) plants and animals are heterozygotes, the homozygotes cannot live.

(B) The monoecious xenogam is a real diploid plant, in population it is heterozygous.

(C) In case of the autogamic plants, homozygous descendant-series are formed by self-pollination continued through generations. In the course of the artificial inbreeding, many traits are broken and perish by turning to the homozygous state because the homologuous chromosomes become more and more similar to one another.

The "clear traits" that have endured inbreeding for 4 to 6 generations in a comparatively constant state (degeneration stops), survive in a homozygous state through long series of generations.

On this basis anybody might say: in the living world the fermion-boson state is forced, Pauli's principle has nothing to do with the genetic system of species because in the homozygous state there are even two identical forces of which just one "would be too many".

In respect of number, we accept the objection. But if we suppose that "one of these forces took a vow to remain entirely or partly silent" — then Pauli's principle is valid.

From the principle of exclusion, the supposition follows unambigously that one of the members of the homologous chromosome pair (paternal or maternal) accidentally becomes genetically inactivated. That is to say, the inbred strait is structurally homozygous but functionally hemizygous. The genetic inactivation, developed in the course of imbreeding, is supposedly characterized by the following.

(a) Heterozygotes have in one of the members of the homologous chromosome pair A_1, and in the other A_2 isoenzyme genes. For instance, in case of two active gene pairs: A_1A_2, B_1B_2.

In case of an ideal hybrid vigor every gene has its different pair.

(b) After self-fertilization more and more homologous chromosome pairs enter into new combinations and in them the gene pairs will be identical. In every identical gene pair (allelic pair) one of the genes becomes inactive. This is the cause of the debilitation of inbred traits.

(c) The genetic inactivation is irreversible and incidental and takes place either in the paternal or in the maternal chromosome.

(d) Genetic inactivity can only be solved by xeno-fertilization (the complimentary gene).

(e) The inactivation of chromosomes cannot be traced by the staining processes, carried out until now. It may, however, be traced by radioautography.

8. The origin of sexuality

The cause and importance of sexual polarization has not been cleared up by biology, as yet. The general opinion is that sex is the speciality of the living world and its "sense" is recombination, serving defence and development against the phenomena of decay.

CORRENS (1928), for instance, emphasizes that bisexual potency is the elementary property of living beings. The contrary opinion is represented by GÁNTI (1977) who emphasizes that sexuality cannot be considered as a generaly characteristic property of living systems because parasexuality is to be observed in procariotes, as well, and even that is not general. We are indebted to Professor P. GREGUSS (1965) for beginning to look for the cause of sexual polarization in the inanimated world. Greguss considers sexuality as a law of nature and reduces its origin to the attraction between the contrast pairs in the inanimate world: "+" and "−" electricity, "acids and bases".

But we had soon to discover that these contrast pairs cannot be the movers of development. If, namely, an electron (e^-) and a positron (e^+) collide, their masses transform into radiation. And when the electron meets a proton (p^+), a hydrogen atom is formed. On the other hand, from the point of view of the living world, the existence of composed atoms is of decisive importance. But in the creation of these the main part is played not by the electromagnetic interaction but by nuclear forces.

The "contrast of acids-bases" has little to do with DNA-formation. Our opinion took shape (9 years ago) in this way. It essentially agrees with the conception of SCHROEDINGER (1951): that the "secret" of living beings, the essence of their organization are to be looked for in the laws of quantum mechanics.

We are convinced that the origin of the mono- and bisexual structures of the cell leads us into the world of subatomic particles. On the basis of our former paper (1978), we do emphasize the following:

1. In the construction of the composed atomic nuclei it is decisively important that two different fermions (proton and neutron) of approximately identical masses and identical baryon charges form an interlinked system in the same quantum state. This is the first bivalent dichotomy (boson state) at the level of the atomic nucleus.
2. In the formation of atomic nuclei, the alternation of the fermion and boson states can be observed.
3. In the formation of the living world, the peculiar construction of the pure boson atoms: C^{12}, N^{14}, O^{16} is determinative.
4. Pauli's principle, based on the connection between spin and symmetry classes, is valid not only for the elementary particles but also for the composed systems formed of the formers.

(A) At prokaryotes, the "fermion" and "boson" states manifest themselves at molecular level. The double-stranded DNA of bacteria, blue-green algae reflects bivalent parity and one of the strands reflects the "fermion" state. Bacteria are, therefore, molecularly diploid.

The free occurring molecular haploids are the RNA and the single-stranded DNA viruses. A number of the double-stranded DNA viruses are supposedly template asymmetrical and, therefore, functionally fermions. It was demonstrated about T_7 phages that the transcription of the mRNA takes place in 99 per cent only from the minus chain. SUMMERS&SZYBALSKI (1968).

(B) The uni- and bilateral character in the eukaryotic cell presents itself at chromosome level. As the chromosome — opposite to one of the chains of the DNA — is representative in itself, too, in case of Protozoa the fermion peculiarity appears in two separate (+ and −) haploid cells. The separation enables the genome (fermion, entity), marked with "+" and "−" characters, to unite. At molecular level, the fermion-boson state changes in a single cell, at chromosome level, however, in separate haploid and diploid cells.

In the interaction of the two different fermions (+, − genomes) two tendencies prevail: On the one hand, they form a strictly linked boson system, on the other hand, they manifest themselves in a comparatively independent form. These are substantially two different degrees of restriction. A strong restriction is, e.g., the hermaphroditic state, a weak one is amphibiousness (dioecia). The fermions "becoming independent" appear in the vegetable kingdom, in the different forms of sexual polarization.

(a) At unicellulars, the sexual character manifests itself only at the level of gametes.

(b) In algae and ferns, the sexual polarization primarily presents itself in gametes and the prothallium.

(c) In case of seedy plants, it already extends over the sporophyton, as well.

The final state of sexual polarization is, in every case, the appearance of emphibious character, the real diploid chromosome number, and the sexual chromosomes. The formation of differentiated sex chromosomes is necessarily tied with the amphibious property.

Male heterogamy has two forms: 2A+XY (mammals); 2A+XO (Protenor type), and similarly, female digamy has also two: A+ZW (Anas type); 2A+ZO (Lymantria). FALUDI (1961). Chromosomes X and Y can participate in different extent in determining sex but the essence is, in each of these cases (XY, YO), that the odd sex chromosomes carry the whole individual into a fermion state.

Social Hymenoptera have no sex chromosomes. In these, the oddness of autosomes, the haploid partogenesis of the male individual lead to sex polarization. The harmonized social activity of the diploid workers of eusocial ants, bees, wasps is made possible by their boson state.

The homogamous XX and ZZ individuals similarly represent a boson state, in respect of their chromosomes; but functionally they are fermions.

In case of mammals, it is known from the investigations of MARY LYON (1961) and RUSSELL (1963) that one member of the XX chromosome, which determines the female sex, becomes inactive in an early phase of embryogenesis.

In the full separation of the two sexes is, therefore, decisive that the genes (or most of them) of the sex chromosomes have no allel or that is inactive.

In this way, the fermion state gets on a higher level, the male and female individuals leave the hermaphroditic restriction but these individuals carry both sexes in their autosomes.

* * *

The editorial board has considered some statements of the monograph as disputable but it agrees to publishing it.

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Address of the author:
Dr. I. MARÓTI
Department of Botany
A. J. University,
H—6701 Szeged, B. O. Box 428,
Hungary